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NOTES ON THE EXCRETORY SYSTEM IN *ASPIDOGASTER CONCHICOLA**

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Aspidogaster conchicola is a cosmopolitan parasite. It is commonly found in Anodon in Central Europe and is the most common parasite of the Unionidae in North America. It has at times been described from gasteropods and infrequently from fishes. Examinations from several distinct centers in China reveals the presence of the fluke in the following host species:

HOST	Specimens Examined	Per Cent Infected	Locality
Unio sp....................	18	44.4	Peking
Vivipara lapillorum..........	2232 440 280	3.2 6.6 11.4	Peking Wuchang Changsha
Vivipara catayensis..........	112	1.7	Changsha
Leuciscus aethiops...........	17	100.0	Wuchang
Amyda sinensis.............	8 20	50.0 5.0	Wuchang Changsha

In the case of the lamellibranch the worms were found parasitic on the renal organ; in the gasteropods they were dissected out of the lymph sinuses of the liver or taken from the spermary. In both the fish and the turtle the worms occurred in the intestine.

The finding of *Asipidogaster conchicola* in several regions in China adds new records of distribution for the species, while the presence of the parasite in the intestine of *Amyda sinensis* allows one to record a new host.

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*Contribution from the Parasitology Laboratory, Department of Pathology, Peking Union Medical College.

The external features of the worm and the digestive and reproductive organs have been adequately studied, particularly by Stafford (1896). From the material at my disposal I was able to develop certain facts regarding the excretory system which have previously been but poorly understood.

THE EXCRETORY SYSTEM IN THE ADULT WORM

This was studied by Stafford (1896: 506-516), who traced correctly the main portions of the system, and followed "a few branches out to the end organs." He states that "with this as a skeleton one can fill in mentally the rest of the branches with their funnel organs and get a fair conception of the semi-excretory system" (p. 511). From this study Stafford was able to hypothecate the "tri-radiate order of branching" and a "tolerably clear symmetry of arrangement." Although he was able to find a more exact symmetry than Huxley (1856) and Voeltzkow (1888), he still found an asymmetrical relation in the anterior branches on right and left sides. He states further that "if all the branchings are regular and the process is repeated six times, we can, by a simple calculation, estimate the number of funnel organs in a single *Aspidogaster*. Thus: $4\times3\times3\times3\times3\times3$ will give the number for one side and doubling this we get a total of 1944."

The apparent asymmetry which Stafford found in the anterior branches is not substantiated by my studies. Still more improbable is Stafford's calculation of the number of ultimate capillaries based on the study of "a few branches followed out to the end organs." Moreover, the irregularities which he notes in other parts of the system can only be interpreted as inadequate analysis. This is particularly true in the light of my studies which indicate *complete symmetry and regularity in the system of the larva as well as in that of the adult.*

While Stafford predicates four main branches, each of which proceeds to trifurcate successively five times, I have found only three such main stems and each of these in turn branches trichotomously only four times. Each of these branches has been traced to its distal termini, with the result that complete regularity is found to obtain (Fig. 1). In other words, the system for each side of the body actually consists of 3 stems, each branching four times, with 81 terminal units, giving a total of 243 capillaries and flame-cells for each side of the body. This, as against Stafford's mental calculation of 972 units which is theoretical and obviously based on inadequate analysis. The system may be expressed as $(3\times3\times3\times3)+(3\times3\times3\times3\times)+(3\times3\times3\times3)$ or $(3)^4+(3)^4+(3)^4$, and reduces to the formula $\alpha^n+\beta^n+\gamma^n$.

These data are supported further by the elemental excretory system which is found in the larva (figs. 5, 6). Here three primitive flame-cells and capillaries are seen which are the basal units of the system, $(\alpha+\beta+\gamma)$. These by successive trichotomies give rise to the adult system.

It seems desirable, in passing, to note that the larva (fig. 7) has paired cluster of cephalic glands (cg), emptying through a cord of cephalic ducts (cgd) just anterior to the oral sucker. This is analagous to the salivary glands described for the redia of *Cercaria equitator* (Ssinitzin 1911: 52, fig. 50) and *C. flabelliformis* (Faust 1918: 34, fig. 43) and might lend support to the view that the aspidobothrid is a redia with germinal epithelium highly differentiated.

SUMMARY

1. Record is made of the presence in several centers in China of the cosmopolitan worm, *Aspidogaster conchicola.* In addition to the usual hosts, *Amyda sinensis* has been found to harbor it.

2. The excretory system of the worm is regular and bilaterally symmetrical. It has three main stems on each side of the body, each stem having a 4-fold trichotomy.

3. This is expressed as $(3\times3\times3\times3)+(3\times3\times3\times3)+(3\times3\times3\times3)$ or $(3)^4+(3)^4+(3)^4$ and may be reduced to the formula $\alpha^n+\beta^n+\gamma^n$.

4. The fundamental $\alpha+\beta+\gamma$ pattern obtains in the larva where each element is represented by a single flame-cell.

5. The presence of cephalic glands in the larva may support the view that the worm is homologous to a highly differentiated redia.

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Key to Figures

α,	anterior fundamental of excretory system.
β,	median fundament of excretory system.
γ,	posterior fundament of excretory system.
b, b_{I}, b_{II},	bladder.
cg,	cephalid gland.
cgd,	cephalic gland duct.
ct,	primary collecting tube.
ep, ep_{I}, ep_{II},	excretory pore.
rt,	reflexed (secondary) collecting tubule.

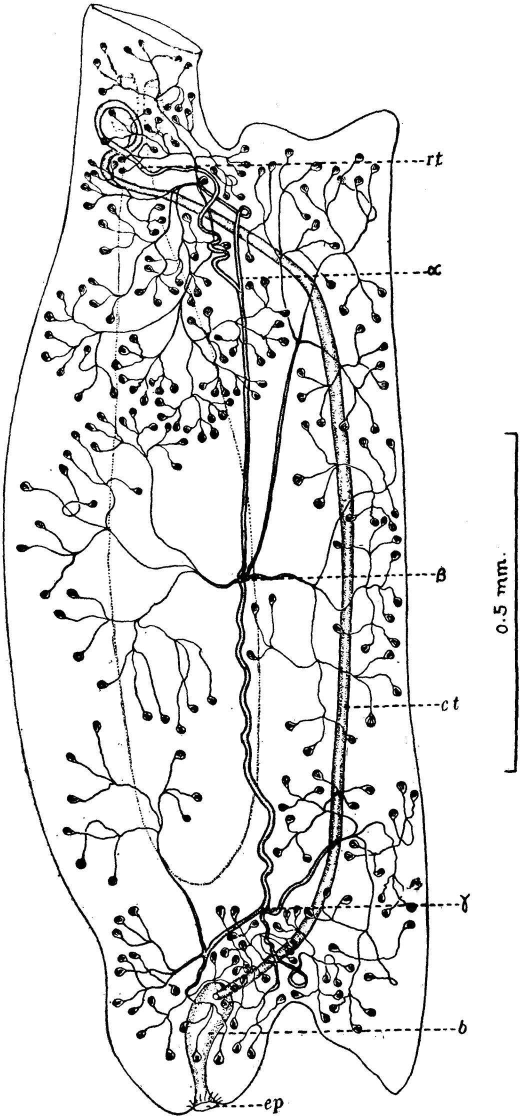

Fig. 1

PLATE XIII

Description of Figures

Fig. 1. Lateral view of adult *Aspidogaster conchicola*, showing complete excretory system for right side of body, X *75*.

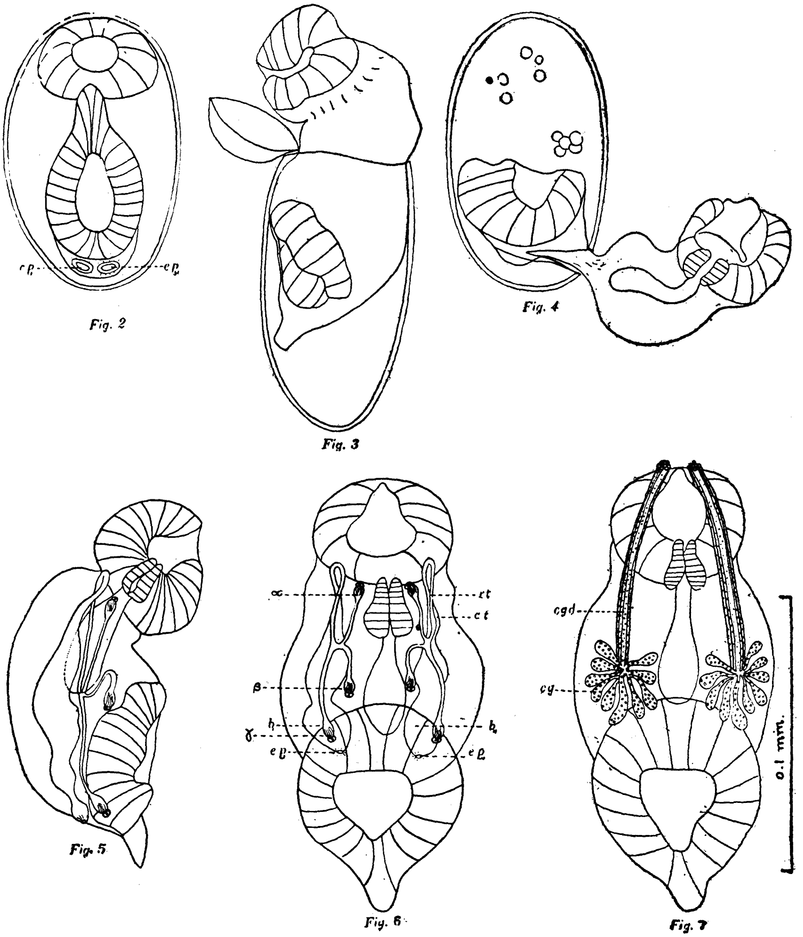

PLATE XIV

Figs. 2 to 4. Stages in the escape of the larva from the egg shell, X *360*.

Figs. 5, 6. Lateral and ventral views of the free larva, showing fundaments of the excretory system. The two sides are seen to develop separately, even to the excretory pores. X *360*.

Fig. 7. View of larva showing cephalic glands and ducts, X *360*.